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Composition, stability, and structure of Cu(II), Ni(II), and Co(II) complexes with adipic acid dihydrazide in aqueous and aqueous-ethanol solutions

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Abstract

Solvation and complexation of Cu(II), Ni(II), and Co(II) with adipic acid dihydrazide (L) in aqueous and aqueous-ethanol solutions (ethanol mole fraction 0.07-0.68) were studied by spectrophotometry. The formation constants of the species M(LH)3+, ML2+, M2L4+ (μ = Cu2+, Ni2+, Co2+), and also M2L 2 4+ and ML 2 2+ (μ = Cu 2+, Ni2+) were determined. With Cu(II), the complexes Cu(LH) 2 4+ , CuL(LH)3+, and Cu 2L(LH)5+ were also detected and characterized. Evidence is given for the hydrazide coordination mode: tridentate in ML2+, bidentate in M(LH)3+ and ML 2 2+ , and tetradentate in M2L4+ and M2L 2 4+ . The ligand exchange reactions involving CuL2+, Cu(LH)3+, Cu(LH) 2 4+ , CuL(LH)3+, CuL 2 2+ , and Cu2L(LH)5+ in aqueous solutions of Cu(II) were revealed and kinetically characterized by nuclear magnetic relaxation. The heretofore unknown rate constants of formation of these complexes were calculated from the thermodynamic and kinetic parameters. Factors controlling the rate constants of the complex formation and chemical exchange are discussed. © Pleiades Publishing, Inc., 2006.

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